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EVER since the development of television and the atomic bomb, research is thought by many to be an easy way of reaching an objective with little or no work or expense. Industries formerly not interested in research, have built laboratories and expected profits to double in a year; uninformed executives have expected research to solve million dollar problems on hundred dollar budgets. Research is producing marvelous results in many areas, but time, work and money are required.

In the development of Nylon for example, six years of work and seven million dollars produced a six foot strand of nylon. It was several more years and many more dollars before nylon, as we know it today, became an industrial reality.

The importance of research is emphasized in a recent statement by Crawford H. Greenewalt, President of the Du Pont Company when he said, "Every new product, every improvement in process, every advance in technology had its beginning somewhere, somehow in the mind of a research worker in his laboratory. Research is the essential vitamin without which the body of industry loses its vitality and dynamic character."

The extent and ramifications of research and development in the field of forest products are too manifold to be completely covered in this brief discussion. For purposes of this presentation only three broad areas of activity will be considered. These groups are:

1. Wood fiber and particle utilization
2. Glued products
3. Improvement of lumber utilization (exclusive of glued products)

Fiber or Particle Utilization

Debarking and Bark Utilization

Many wood products require bark free wood particles or wood fibers. Consequently, important advances in the utilization of sawmill residues depended to a large extent on the complete removal of bark from the useable wood material. The types of barkers that have been tried cover a wide variety of procedures and even in this area of Northern Idaho a good many different methods of barking are actually in use today.

Hydraulic barking is one of the more popular procedures. With this type, water under pressure of approximately fifteen hundreds pounds per square inch is forced through special nozzles which direct the water against the surface of the log to remove the bark.

Mechanical barkers are also numerous. An early model was an adaptation of the pole shaver as used in pressure treating plants to remove the bark from poles. In another type the log is passed through a rotating ring on the inside of which are located three or four arms which can be forced in against the log and more or less scrape the bark from the log. Many other types of barkers have been built and are in use. For the most part, all of them are for medium to large mills and are expensive to build and maintain. There is still a great need for an inexpensive barker to use in small mills.

With the bark separated from the wood the next problem is the utilization of this bark. Most mills burn it, but the bark removed in the hydraulic barkers presents some problems because of the high moisture content of the mass of bark. The manufacture of salable products has actually succeeded in three mills in the western part of the United States; two of these mills are redwood operations, the third is Douglas Fir.

A wide variety of products are produced from Douglas Fir bark at the Longview mill of the Weyerhaeuser Timber Company. Here the Douglas Fir bark is ground in suitable machinery and screened to give a variety of products. They have the general trade name "Silvacon" and are used in a variety of end products. Just a few examples include the following:

1. Replacement or extender in phenolic resins
2. Soil conditioner
3. Waxes
4. Provide a source of tannin
5. Ground cork
6. Conditioner for oil well mud

Products from redwood bark may be obtained either by grinding and screening or chemical processing. Here the end products include some of the same items produced in Douglas Fir bark and in addition may be used as dispersing agents or for ore floatation.

Hardboard

Most people are familiar with Masonite which is a hard, dense relatively thin board having at least one smooth, more or less uniform surface. Boards in this class are generally considered hardboards and are made from fiber that has been produced from wood by some sort of pulping process. The development of new hardboard processes and the consequent expansion of the manufacturing facilities is certainly one of the most striking developments since the end of World War II. In 1948 there were only two plants in this country producing hardboard. Today there are fourteen. The twelve new plants are producing a total of approximately 2,000 tons per day.

Particle Board

Another board product receiving wide-spread attention within the last few years is formed by mixing relatively fine wood particles with small amounts of resin, forming the mixture into a sheet and then curing the resin under the influence of heat and pressure. The particle board is a little lighter in weight than the hardboard but generally it is made in thicker sheets. In manufacture it offers the advantage of complete elimination of the drying problem and commercial sizes of equipment are much less expensive than for the manufacture of hardboard.

During the last ten years a number of types of particle board have been developed in this country and others have been introduced from Europe. Furniture manufacturers have examined the products from time to time; probably the first to adopt chipboard as a regular part of practically 100% of its production was the Lane Company, manufacturer of cedar chests in Altavista, Virginia.

In addition to furniture the particle board is considered suitable for the core in flesh doors; for the core in panels of radio cabinets; it is being considered for interior partitions and other uses where large size at small cost is required.

Agricultural Uses

Finely divided mill residues such as sawdust or bark particles, are receiving increased attention as a possible aid to agriculture. In this area their uses include a mulch for orchards, truck crops and for small fruit, litter in barns and feed lots and as a soil conditioner.

Pulp and Paper

Probably there is more research devoted to the development of improvements in pulp and paper processes than all other wood products combined. As a result we see advertised on television cleansing tissues that will retain their strength even when soaking wet; we have fiberboard boxes that can withstand repeated or long time soaking; the proportion of the pulpwood finally included in the paper sheet is increasing.

Perhaps one of the most interesting developments in the field of pulp and paper today is concerned with so-called semichemical pulping processes. In 1940 only 465 tons of this pulp were produced. This year well over three thousand tons of semichemical pulp will be produced. The semichemical pulping processes are of interest because they produce a greater amount of paper from a given amount of wood and they are less expensive to produce. Furthermore, the semichemical processes have been found highly satisfactory with hardwoods—a development of particular interest in the Lake States and Northeast where paper mills were established for the use of softwoods but where many of the forests have now converted to hardwoods.

In the early days of semichemical pulp manufacture it was used for such low grade items as corrugating medium and coarse paper. Today, however, it finds acceptance in bleached papers, high quality white papers, coated book, magazine covers, bond and grease proof. It is also now being considered for waxing, for carbon papers and for paper towels.

Glued Wood Products

Veneer and Plywood

Of all the glued laminated products undoubtedly veneer and plywood develop the greatest value. In this area extensive research is constantly under way to provide new glues, cheaper methods of manufacture and one of the important areas, is to find suitable material to replace the expensive clear material that is now demanded in the best grades of plywood. Methods of machining the surface of the wood to give it attractive appearances and also eliminate any blemishes on the face have been developed and are finding wide-spread acceptance. This machining may be provided by running under a special head, by wire brushing, sand blasting, or by other means. Plywood sheets are also being overlaid with other materials such as hardboard, paper and fiber coatings.

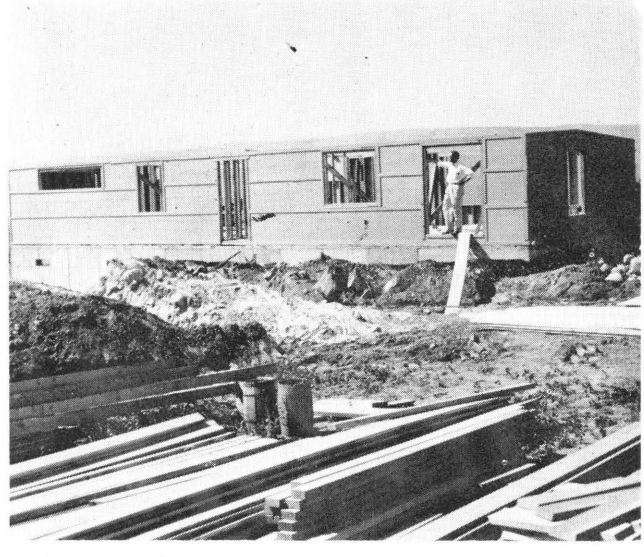


Figure 1.—The first house constructed with paper overlaid lumber used as sheathing.

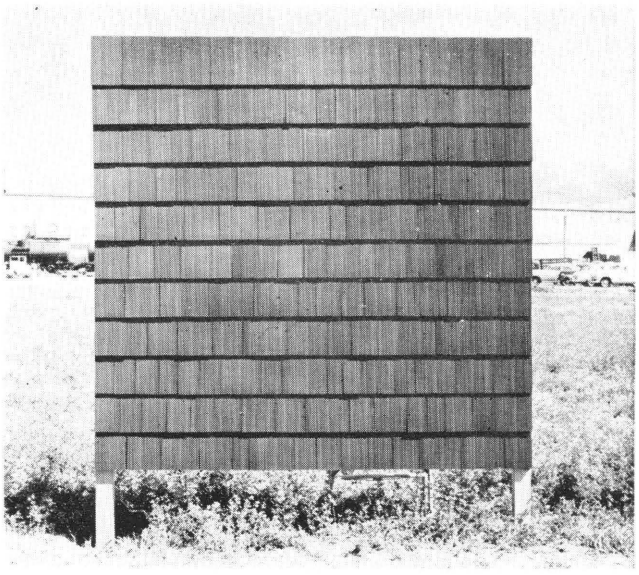


Figure 3.—A demonstration of the ability of the lumber-paper sheathing panel to hold side wall shingles.

Laminated Timbers

The dollar volume in laminated products is not as high as in veneer and plywood, yet some of the developments in this area are more interesting and striking. Since 1950 the U. S. Navy has conceived, designed and built all wood minesweepers as a means of overcoming the danger of magnetic mines. The all wood minesweepers were made possible because of techniques of laminating developed by industry and important design procedures developed by the U. S. Navy's Bureau of Ships. The new ships designed to take the full advantage of wood's strength were so much lighter in weight than some earlier designs that nearly twice as much useful apparatus could be included in the ships gear.

Another development in the field of laminating has been the design and construction of a new all wood truck body by the Timber Engineering Company. The basic unit of this new truck is a laminated frame member which extends continuously from the top of one side of the truck down the side, across the bottom, and up the other side. Such a member is made possible by using thin pieces of wood coated with glue and then bent into shape and pressed to form the frame member of the truck. The rest of the truck is built with plywood or laminated members to complete the construction of the all wood truck.

Many other uses of laminated lumber include arches for churches, schools and other public buildings requiring long, clear spans, laminated 2x4's and edge glued or wide panel stock made by gluing pieces edge to edge.

Overlays

The idea of applying thin sheet material over a thicker sheet of another material is by no means new—furniture manufacturers for many years applied thin sheets of fancy veneers over thick layers of less attractive woods. In recent years, however, thought has been given to the application of other types of overlays to wood products for other utilitarian purposes. One of the older applications has been the use of resin impregnated paper applied to the surface of plywood to give a much more wear resistant and weather resistant surface. The use of resin impregnated papers is now expanding to provide better paint surfaces to plywood; it is the subject of extensive studies by the U. S. Forest Products Laboratory and other agencies. The application of paper to lumber will provide the customers of the lumber industry with a good utilitarian product having a much more attractive appearance than many of the lower grade boards can now provide.

Formica sink tops and plastic table tops are now widely available. These products are developments in the field of overlays where resin impregnated sheets are glued generally to a wood or hardboard or particle board backing.

Another area of overlays uses low resin content paper or paper without any resin, glued to wood either to increase strength, dimensional stability or to improve the surface appearance. The Kraveneer process which was made public shortly after World War II, is a means of applying paper to green veneer, drying it and then utilizing the end product as the facing for wire bound boxes. More recently the Weyerhaeuser Timber Company at Springfield, Oregon has gone into the production of Plyveneer, a product made by gluing paper to dry veneer in a machine that produces the product in a continuous ribbon four feet wide. This ribbon is cut off into sheets of desired length. The product is intended for use as a box material and also sold as a general sheathing product.

Improving Lumber Itself

The preceding discussion has been entirely concerned with either chemical conversion of the wood

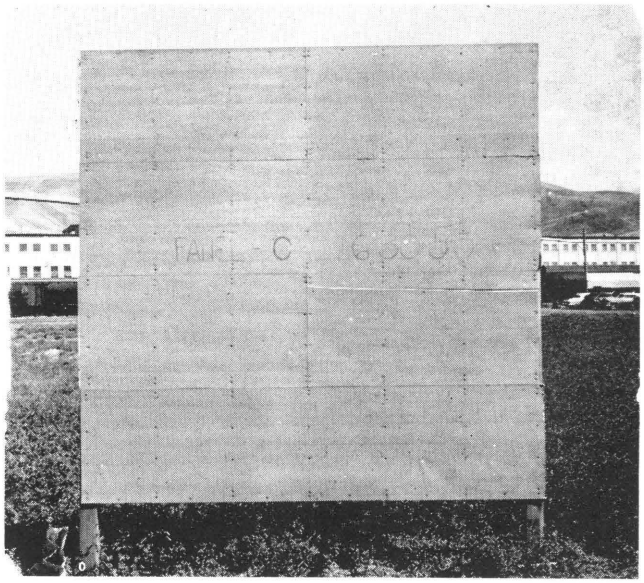
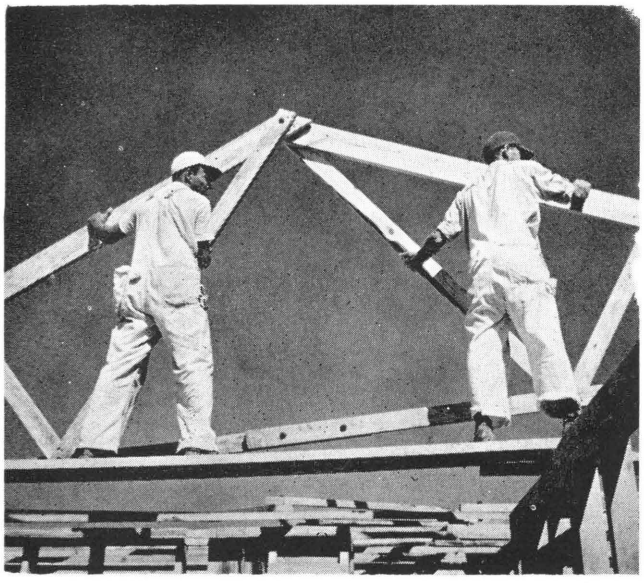


Figure 2.—An exposure test panel of paper overlaid lumber sheathing.



Teco Photo

Versatile, economical Teco trussed rafters eliminate load-bearing partitions, provide flexibility of interior open planning, and save time, material, and labor. They are simple to fabricate from 2x4s and 2x6s, quickly assembled with Teco Wedge-fit split ring connectors, and easily erected on the exterior walls with minimum time and labor.

Teco Photo

Innovations in modern vehicle construction are these three all-wood, military truck body prototypes, developed and built at the Timber Engineering Company laboratory for Army Ordnance. They are shown, above, on their way to the Army's Aberdeen, Maryland, Proving Ground, where they performed satisfactorily throughout 14 months of rigorous tests.

Latest advancements in wood technology are embodied in the three prototypes, including one-piece, bent laminated wood frames that provide maximum strength. All wood members are treated with preservative and for dimensional stabilization. A 100 percent waterproof glue was used in all laminating and edge-gluing.

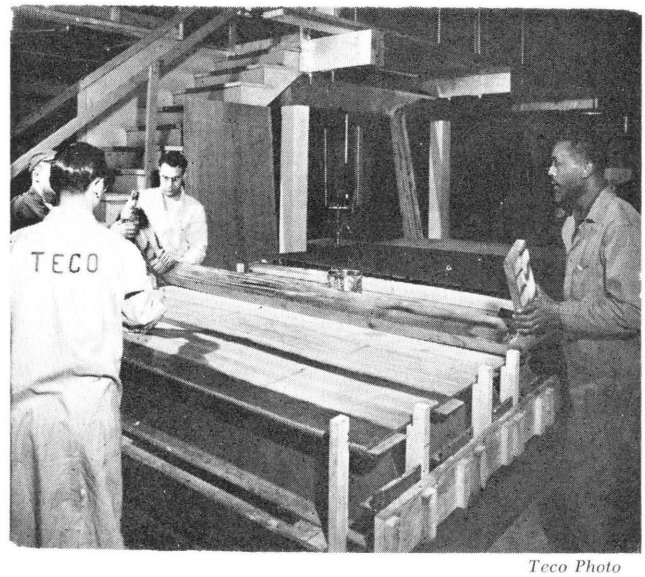
or modification of the wood by gluing. There are, in addition to such processes, actual improvements of wood itself and the way it is used. One of the outstanding examples developed in this country in recent years is the Teco* timber connector system of construction. These small timber connectors greatly improve the efficiency of joints. For example, one small connector may provide a joint as strong as that made by five bolts. Trusses developed with these connectors in their joints have been used for spans over two hundred feet. Research is constantly under way in the Teco laboratory to improve the design of Teco trusses. Recent developments have included a truss which can be readily used for housing units.

Doweled Planking

In the last few years a manufacturer of oak lumber in the Ohio Valley became interested in better utilization of some of his left overs and his low grade lumber. He conceived the idea of gang ripping his low grade, cutting defects out of the strips, tonguing and grooving his ripped pieces and then fastening these pieces back together again by means of dowels. Laboratory as well as service tests have shown that this plank has a great many advantages over ordinary plank. It comes in large sizes and is easily and economically laid. It provides thoroughly seasoned material in thick sizes, it is less subject to shrinkage than glued laminated lumber, it has good wear resistance and is also strong. The doweled planking is now being widely used for homes, public buildings, warehouses, truck floors, railway car floors and the like.

Conclusion

These are but a few items that are receiving the attention of scientists throughout the nation. Many more are in the laboratories or early stages of production. Although wood is serving mankind in many new ways in many new forms, mother nature's originial product, wood, is unsurpassed in its native form for a host of uses. The piece of wood, probably man's first implement, is still providing, and will always continue to provide, useful, efficient, and economical service to humanity.



Teco Photo

Key to the high strength and low weight of the all-wood Army truck body prototypes are the one-piece, U-shaped, bent laminated frames of black gum veneer. Above, a frame is being affixed to the bottom of one of the prototype bodies at the Teco laboratory where the military vehicles were developed and built.

*Timber Engineering Co., Washington, D.C.